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Distribution and Taxonomic Status of the Stoneroller,

Campostoma anomalum, in Illinois

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ABSTRACT : Examination of more than 1,000 specimens of *Campostoma anomalum* from Illinois and surrounding areas reveals the presence of two subspecies. The nominate *C. a. anomalum*, previously believed to extend only to southeastern Indiana, occurs in Ohio River tributaries of southeastern Illinois and western Kentucky. It intergrades in a rather narrow zone with *C. a. pullum*, which occupies the rest of the upper Mississippi Valley, except for a small area in south-central Illinois where habitat is lacking. Quantitative data are presented that show general uniformity of *pullum* populations throughout the area and no evidence of clines.

INTRODUCTION

The stoneroller, *Campostoma anomalum* (Rafinesque), consists of two subspecies in Illinois and adjacent areas : *C. a. anomalum* and *C. a. pullum* (Agassiz) . The former is a widespread eastern subspecies that is now known to extend westward into tributaries of the Ohio River in southeastern Illinois. The latter occupies the remainder of the upper Mississippi River valley, including most of the Great Lakes region, and ranges westward onto the Great Plains. The two subspecies are distinguished principally on the basis of differences in scale counts and gape width (Hubbs and Greene, 1935 ; Gerking, 1945 ; Trautman, 1957) .

Although several workers have discussed these two forms in adjacent or nearby states, few quantitative data have been published. Gerking (1945) cursorily analyzed intergradation between them in Indiana, but his results now appear to need revision. Trautman (1957) presented detailed maps of their distributions in Ohio and listed diagnostic characters. Burr and Smith (1976) presented quantitative data for *C. a. pullum* where it occurs with the closely related *C. oligolepis* in the upper Mississippi River valley, but beyond the area of sympatry they did not discuss subspecific variation in *C. anomalum*. This paper, based on the extensive material in the Illinois Natural History Survey collection, is an analysis of geographic variation in *C. anomalum* throughout Illinois.

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METHODS AND MATERIAL

Counts and measurements were made in the conventional manner and follow Hubbs and Lagler (1958) except that number of scales above the lateral line was from lateral line to lateral line just anterior to the dorsal fin. Measurements were made with dial calipers on specimens measuring more than 60 mm standard length (SL) to the nearest 0.1 mm. Over 1,000 specimens of *C. anomalum* were examined from throughout Illinois and adjacent states. For complete locality data on all specimens studied, see the original dissertation (Burr, 1974).

DISCUSSION

C. a. anomalum and *C. a. pullum* were first recognized as subspecies by Hubbs and Greene (1935). Hubbs and Lagler (1958) indicated the range of the former as "throughout the Ohio Valley from Indiana (east of the Wabash basin) ... east to the Appalachian Mountains ..." and that of *pullum* as "from the Wabash River system westward to Iowa and thence southwesterly ... to northeastern Mexico. . . ." Gerking (1945) concluded that *C. a. anomalum* was present only in the White-water drainage of southeastern Indiana and that the rest of the Indiana populations were intergrades between *anomalum* and *pullum*. While it is true that *C. a. pullum* occupies the Wabash River system, somewhat farther south *C. a. anomalum* extends westward all the way across Kentucky to the lower Ohio River drainage of southeastern Illinois.

C. a. anomalum and *C. a. pullum* are morphologically very similar, but *anomalum* has larger scales than *pullum* (Tables 1 and 2). The difference in scale size is expressed in the number of scales above the lateral line (usually 15-17 in *anomalum*; usually 18-20 in *pullum*); body circumferential scales (Table 1); the sum of body circumferential and lateral line scales (Table 1); lateral line scales (Table 2); and predorsal scales (Table 2). *C. a. anomalum* also tends to have a wider gape than *pullum*. Gape width measurements made on 30 non-breeding specimens of *Campostoma anomalum* (expressed in thousandths of SL) are as follows: *C. a. pullum* range of gape width 44-58 (mean = 50); *C. a. pullum* X *C. a. anomalum* range of gape width 40-55 (mean = 47); *C. a. anomalum* range of gape width 44-60 (mean = 55). The difference between the two subspecies in gape width diminishes when breeding individuals are compared. The two subspecies can also be separated by differences in the number of gill rakers on the first arch (counted on the right side of the body). *C. a. pullum* had a range of 26-35 (mean = 30.0) in 31 specimens; *C. a. pullum* X *C. a. anomalum* had a range of 27-32 (mean = 29.3) in 18 specimens; *C. a. anomalum* had a range of 21-29 (mean = 24.9) in 14 specimens. Counts from throughout the range of the two subspecies fall within the above range limits. The two subspecies lack meaningful differences in tuberculation, fin pigmentation, nonbreeding and breeding coloration, pharyngeal tooth counts, fin ray counts and features of the cephalic lateral line system.

Scale counts, especially body circumferential scales, the sum of body circumferential and lateral line scales, and the number of gill rakers on

Table 2. Frequency Distribution for Scale Counts in *Campostoma anomalum* from Illinois and Adjacent Kentucky and Indiana (refer to Fig. 1 for localities from which specimens were examined).

| FORM | Lateral Line Scales | | | | | | | | | | | | | | | | | | | | No. | mean |
|--|---------------------|----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|------|-----|------|
| | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | | | |
| <i>C. a. anomalum</i> | 1 | 46 | 100 | 120 | 183 | 125 | 110 | 84 | 55 | 28 | 10 | 5 | 4 | 2 | 1 | — | — | 1 | 875 | 50.8 | | |
| <i>C. a. pullum</i> X <i>anomalum</i> | 3 | 9 | 8 | 21 | 14 | 28 | 17 | 11 | 6 | — | 1 | 1 | | | | | | | 119 | 49.5 | | |
| <i>C. a. anomalum</i> | 1 | 6 | 12 | 10 | 9 | 10 | 3 | | | | | | | | | | | | 51 | 48.2 | | |

| FORM | Predorsal Scales | | | | | | | | | | | | | | | | No. | mean |
|--|------------------|----|----|----|-----|-----|-----|----|----|----|-----|------|--|--|--|--|-----|------|
| | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | | | | | | | |
| <i>C. a. pullum</i> | | | 30 | 84 | 196 | 252 | 192 | 87 | 28 | 5 | 874 | 23.0 | | | | | | |
| <i>C. a. pullum</i> X <i>anomalum</i> | 5 | 6 | 17 | 30 | 33 | 19 | 7 | | | | 117 | 21.4 | | | | | | |
| <i>C. a. anomalum</i> | 8 | 23 | 14 | 3 | 1 | 2 | | | | | 51 | 19.5 | | | | | | |

the first arch, are the only reliable means for identifying *C. anomalum* to subspecies, other than by geography. Using scale counts, the distinction between the two subspecies, at least in Illinois, is more consistent than only cursory examination would indicate. For example, a line drawn in Table 1 between 38 and 39 body circumferential scales (excluding intergrades) separates 97.9% of *pullum* from 78.4% of *anomalum*, an average index of divergence (Ginsburg, 1954) of 88.1%.

Although habitat preferences between *anomalum* and *pullum* are very similar, there is some indication from the overall distribution patterns that *anomalum* is a more montane form primarily restricted to the Ohio Valley and certain streams of the Appalachian Mountains (Ross, 1952), and that *pullum* is a more western form tolerating various bottom types, and labile ecological conditions (Cross, 1967; Burr and Smith, 1976).

Campostoma anomalum anomalum (Rafinesque)
Ohio Stoneroller

Rutilus anomalus Rafinesque, 1820 :20 (original description; Licking River, Ky.).

[*Campostoma anomalum anomalum*]: Jordan, 1876:326 (first use of trinomial by virtue of his description of variety *prolixum*).

Campostoma anomalum anomalum: Hubbs and Greene, 1935 :93 (first to apply the nominate form as a trinomial).

Diagnosis. —A subspecies of *Campostoma anomalum* distinguished from *pullum* by a combination of the following characters: scales in lateral-line 45-51 (usually 46-50); body circumferential scales 34-41 (usually 36-39); usually with 15-17 scales above the lateral line; predorsal scales 18-23 (usually 19-20); and sum of body circumferential and lateral line scales 83-91 (usually 83-88).

Illinois Distribution. In Illinois, *C. a. anomalum* is restricted to direct tributaries of the Ohio River in Hardin County, and more northern tributaries of the Ohio River in Pope, Johnson, and Massac counties (Fig. 1). A similar disjunct distribution pattern is exemplified among several other fishes (*Hypentelium nigricans*, *Ambloplites rupestris*, *Micropterus dolomieu*), which in southern Illinois are virtually limited to these same stream systems.

Variation. The Illinois populations of *C. a. anomalum* typically fall within the range of meristic values listed by Trautman (1957) for Ohio. In view of this, the comment by Gerking (1945) that all but the populations in the Whitewater drainage were intergrades between *anomalum* and *pullum* is almost certainly erroneous. In fact, the counts from direct tributaries of the Ohio River presented by Gerking (1945: Table 5) are typical of *C. a. anomalum*. Body circumferential scale counts for these specimens ranged from 36-44 (the extremes for *C. a. anomalum* in Illinois are 34 and 41 and in Ohio are 35 and 43). It is also unlikely that all of the remaining populations in Indiana are intergrades between the nominate subspecies and *pullum* since scale counts from the Wabash, Kankakee, and Vermilion rivers in Illinois adjacent to Indiana are typical *pullum*.

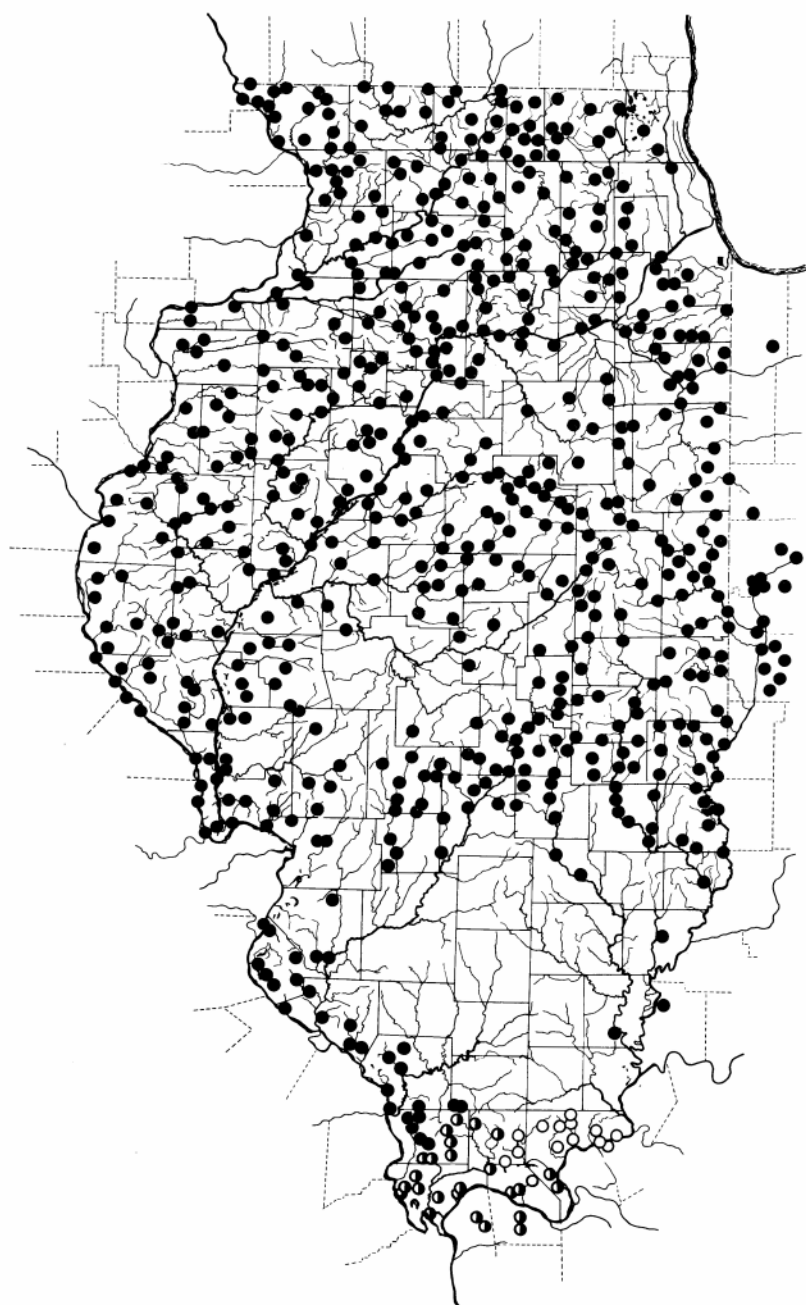


Fig. 1. Specimens examined of *C. a. anomalum*, *C. a. pullum*, and their intergrades in Illinois, western Indiana, and western Kentucky. Solid circles denote *pullum*; open circles *anomalum*; half-solid circles intergrades.

Specimens of *C. anomalum* from the Cache River, direct tributaries of the Mississippi River in Alexander County, tributaries of the Ohio River in Pulaski, Massac and Pope counties, Illinois, and tributaries of the Ohio River in McCracken and Ballard counties in Kentucky are interpreted as intergrades between the nominate subspecies and *C. a. pullum* (Fig. 1). Identification is based primarily on several meristic characteristics (Tables 1 and 2) which are intermediate between the two subspecies. Although apparently pure populations of *anomalum* exist in the eastern Illinois tributaries of the Ohio River (Fig. 1) some downstream collections from these populations contained intergrades. Since stonerollers migrate rather extensively (Metcalf, 1959) it is likely that considerable gene exchange takes place within these streams. However, since the old Ohio River course passed through these regions in pre-Wisconsin times it is also possible that the downstream intergrade populations are the result of recent Mississippi River invasions into the present course of the Ohio River.

Campostoma anomalum pullum (Agassiz)

Central Stoneroller

Chondrostoma pullum Agassiz, 1854:357 (original description; Burlington, Iowa).

Cam postoma anomalum pullum: Cope, 1880:36 (reported from Upper Medina River, Helotes, Texas and Comanche Creek, Mason, Texas. No description accompanied the records). Hubbs and Greene, 1935 :89 (first recognized the proper name of the wide-ranging *C. a. pullum* as that form described by Agassiz).

Diagnosis. —A subspecies of *Campostoma anomalum* distinguished from *anomalum* by a combination of the following characters: scales in lateral line 46-63 (usually 48-55); body circumferential scales 36-50 (usually 38-47); usually with 18-20 scales above the lateral line; predorsal scales 20-27 (usually 20-26); sum of body circumferential and lateral line scales 85-108 (usually 87-100).

Illinois Distribution. *C. a. pullum* occurs in all major drainages in Illinois except for a sizable area in the south-central part of the state just north of the Shawnee Hills (Fig. 1). This hiatus is presumably due to a lack of suitable habitat. While many of the streams inhabited by *C. a. pullum* have deteriorated somewhat, the habitat available to *pullum* has probably increased because many streams that were at one time moderately large and stable are now smaller, more shallow, and physically similar to headwater habitats.

Variation. Illinois populations of *C. a. pullum* vary from river system to river system with no distinct pattern although counts in the Wabash drainage are slightly higher than others (Burr and Smith, 1976). Gerking (1945) showed counts in the Wabash River to be higher than in other Indiana drainages studied. Extreme southern Illinois populations of *C. a. pullum* have scale counts similar to those in northern Illinois with no significant differences in their means. Populations throughout the upper Mississippi River valley are surprisingly uniform in meristic characteristics (Pflieger, 1971; Burr and Smith, 1976).

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